

CHAPTER IX

COMMERCIAL SPACE TRANSPORTATION

The Federal Aviation Administration's (FAA) Associate Administrator for Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch activity as authorized by Executive Order 12465, *Commercial Expendable Launch Vehicle Activities*, and the *Commercial Space Launch Act of 1984*, as amended. AST's mission is to license and regulate commercial launch and reentry operations to protect public health and safety, the safety of property, and the national security and foreign policy interests of the United States. In addition, the FAA licenses commercial launch sites. The *Commercial Space Launch Act of 1984* and the *1996 National Space Policy* also direct the DOT (FAA) to encourage, facilitate, and promote commercial launches.

INTRODUCTION TO COMMERCIAL SPACE TRANSPORTATION

WHAT IS COMMERCIAL SPACE TRANSPORTATION?

The term "commercial space transportation" refers to the launch of an object into space or the reentry of an object from space by a private, non-government entity. Typically, commercial space transportation concerns the activities of launch service providers – companies that place satellites into orbit under contract from corporations, governments, universities, or other organizations. Launch service providers may also conduct suborbital flights, which are typically launches of objects high into the atmosphere or into space that return to Earth instead of entering orbit. The world's major launch service providers are in the United States, Europe, Russia, and China. Other countries, such as Brazil, Japan, and India, are attempting to enter the market.

The FAA issues licenses to companies that conduct commercial launches in the United States and to

U.S. companies that conduct launches outside U.S. territory. Examples of launch service providers who receive FAA licenses are Lockheed Martin's International Launch Services (ILS), Boeing Launch Services (BLS), and Orbital Sciences Corporation (OSC). The FAA also issues licenses for suborbital launches. Licenses from FAA/AST may also be required for certain large hobby or research rockets, depending on the rocket's motor impulse, operating time, and ballistic coefficient factors.

Suborbital launches by private entities are an increasingly important regulatory activity for the FAA. Several organizations are developing reusable suborbital vehicles designed to carry people or payloads to and from very high altitudes. The following sections will briefly describe the history of the commercial use of space, U.S. orbital launch service providers, and the emerging suborbital service providers using new reusable vehicles.

COMMERCIAL USE OF SPACE

Since the launch of Sputnik in 1957, spaceflight has largely been a government endeavor. Even though satellites serving commercial or quasi-commercial purposes went into service in the early 1960s, the business of launching them was strictly a government affair. Many of the early commercial satellites launched were telecommunications spacecraft located in geosynchronous Earth orbit¹ (GEO) used to relay video and audio signals for television and telephone services.

Launches of satellites that serve commercial purposes have steadily increased from the early

¹ A spacecraft in geostationary Earth orbit is synchronized with the Earth's rotation, orbiting once every 24 hours, and appears to an observer on the ground to be stationary in the sky. GEO is a broader category used for any circular orbit at an altitude of 35,852 kilometers with a low inclination (i.e., over the equator).

1980s to the late 1990s. In 2003, commercial launches represented about 27 percent of the total orbital launches conducted worldwide. Until the mid-1990s, commercial satellites were almost exclusively telecommunications satellites located in GEO.

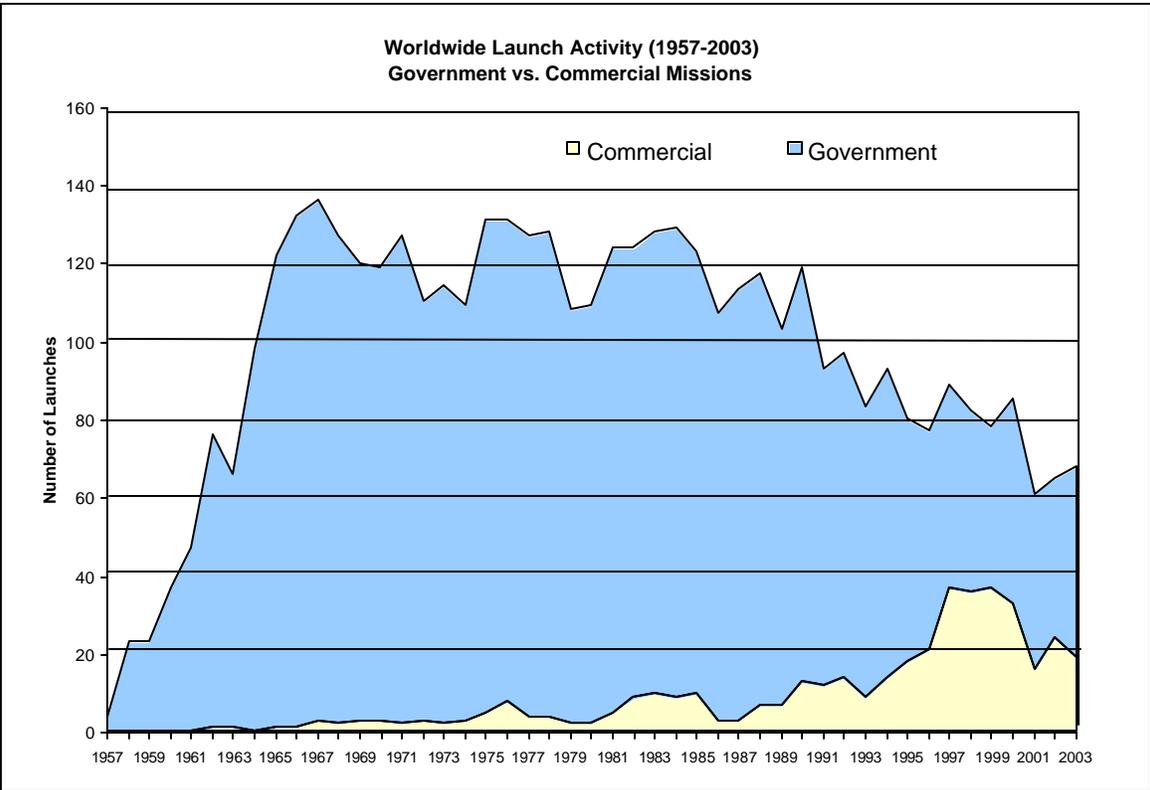
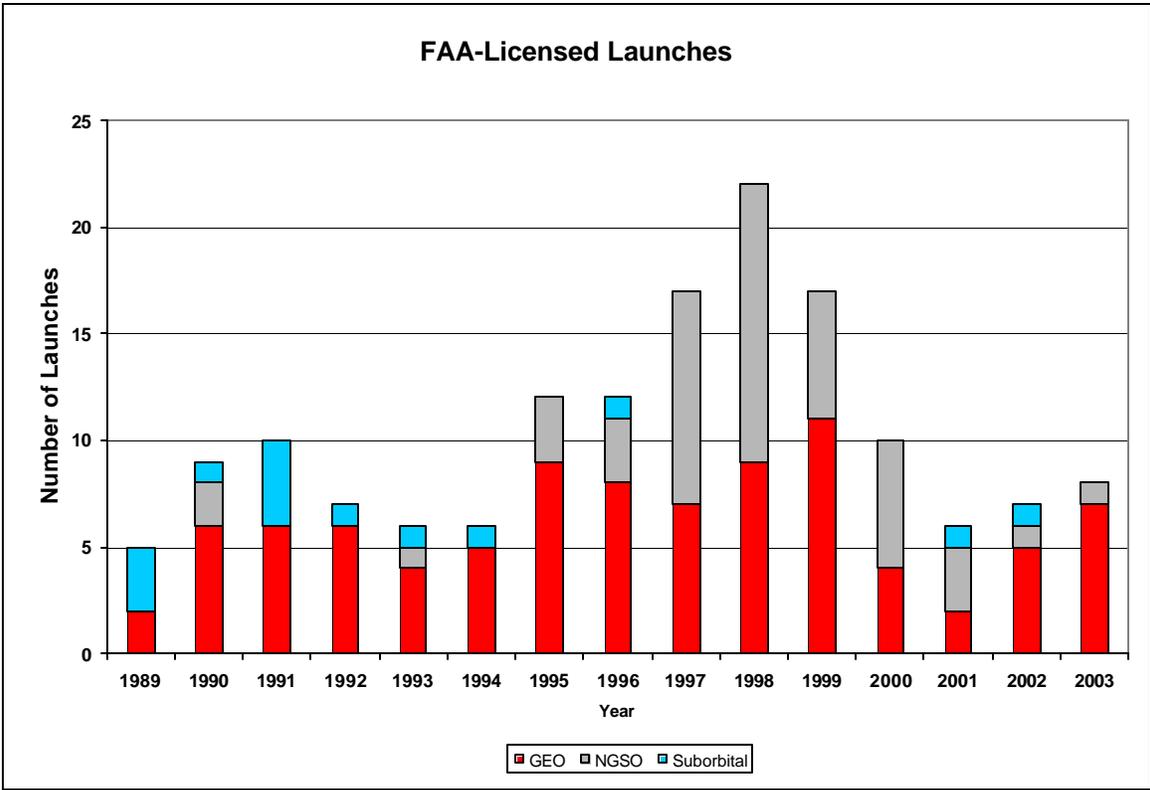
Since 1997, new satellite markets have opened up for commercial mobile telephones, data messaging, and remote sensing in low Earth orbit (LEO) or non-geosynchronous orbit (NGSO).² Digital satellite radio services began in North America in late 2001.

Other types of commercial launches are also emerging. Cargo flights to the Mir Space Station, partially funded through private parties, took place in the 1990s, and two space tourists have paid for seats on Russian spacecraft for rides to the International Space Station. Public space travel is expected to increase in the future as current and new entrepreneurial companies develop passenger vehicles capable of suborbital and orbital space flights.

U.S. COMMERCIAL LAUNCH SERVICES

Up until the early 1980s, all commercial satellites were launched on rockets owned and operated by the U.S. government, including the Space Shuttle. When Europe's Arianespace began offering launch services for commercial satellites in 1983, an international launch market was created and has since grown to over 15 vehicle families worldwide.

² Non-geosynchronous orbit (NGSO) satellites are those in orbits other than GEO. They are located in LEO (lowest achievable orbit to about 2,400 kilometers), medium Earth orbit (MEO, 2,400 kilometers to GEO), and all other high or elliptical orbits or trajectories.



Following the passage of the *Commercial Space Launch Act of 1984*, the U.S. government and industry began to transition from government to commercial operations for expendable launch vehicles (ELVs). The *Commercial Space Launch Act* authorized the Department of Transportation (DOT) to regulate and license commercial launch activities. From 1989 through the end of 2003, the DOT has licensed over 150 orbital and suborbital commercial launches.

NASA and the U.S. Air Force continue to launch government satellites, which include flights of the Space Shuttle. These flights are not considered commercial by the FAA because they are conducted for and by government agencies and not by the private launch service provider, even though the same vehicles may be used. Occasionally, a U.S. government agency may contract a private launch service provider to deploy a satellite, or may contract a satellite manufacturer to build a satellite and deliver it on orbit. In this case the manufacturer would contract with a private launch service provider. Launches of U.S. government payloads may or may not be FAA-licensed as commercial depending on who is conducting the specific launch. Launches of foreign government satellites on U.S. vehicles are nearly always contracted through the private service providers and are considered commercial.

Launch providers continually upgrade their vehicles to keep pace with the marketplace and technology and retire older models.

Currently active ELVs that are licensed by the FAA for orbital launches include:

- Atlas 2, 3, and 5 (intermediate to heavy class), all built by Lockheed Martin and marketed by International Launch Services (ILS);
- Delta 2 (medium class) and Delta 4 (intermediate class), built by The Boeing Company and marketed by Boeing Launch Services (BLS).
- Zenit 3SL (intermediate class), built by KB Yuzhnoye (in Ukraine) for the Sea Launch partnership and marketed by BLS; and
- Pegasus XL and Taurus (small class), both built and marketed by OSC.

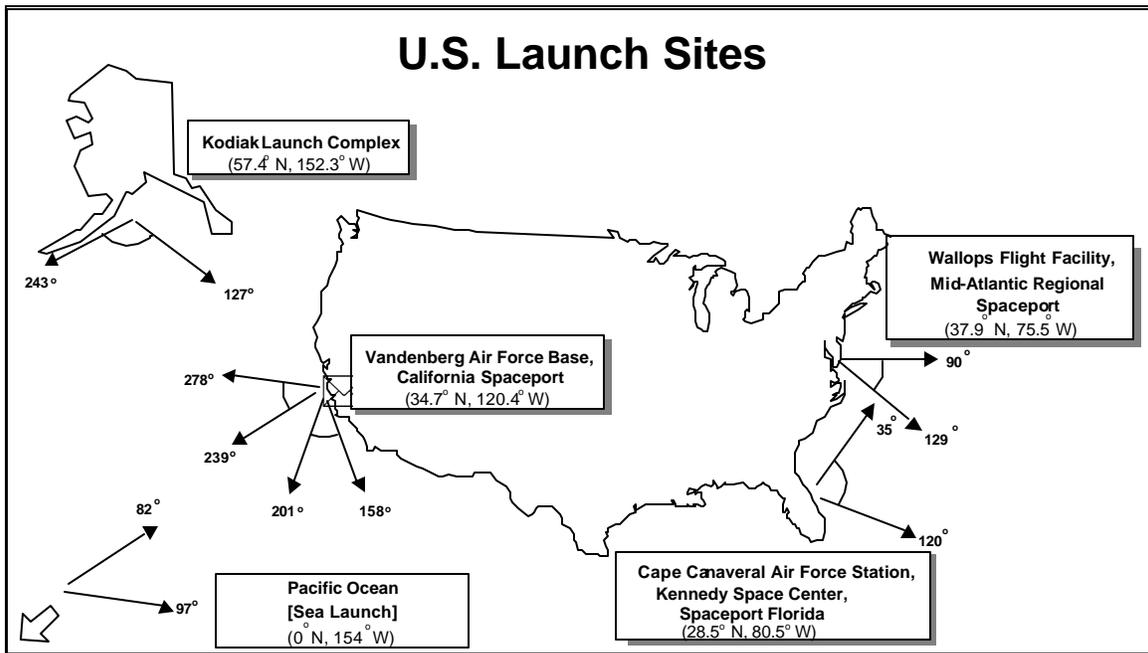
New expendable and reusable launch vehicles (RLVs) are also being developed for orbital and suborbital launches.

A Delta 4 heavy version is being prepared by Boeing Launch Services for a demonstration launch scheduled in 2004 and a heavy lift version of the Atlas 5 is under development by Lockheed Martin.

The Falcon, developed by SpaceX with a first launch in 2004, can carry satellites up to 454 kilograms (1,000 pounds). SpaceX intends to develop a more powerful version, capable of lifting up to 4,200 kilograms (9,259 pounds) to LEO.

US and International Partner Commercial Launch Systems									
	Small		Medium	Intermediate		Heavy			
									
Vehicle Name	Pegasus	Taurus	Delta 2	Delta IV	Atlas II/III	Atlas V	Proton*	Zenit 3SL	Delta IV Heavy
Company	OSC	OSC	Boeing	Boeing	ILS	ILS	ILS	Sea Launch	Boeing
First Commercial Launch	1993	1998	1989	2002	1990	2002	1996	1999	-

*Not FAA Licensed



New suborbital vehicles capable of carrying human crews include SpaceShipOne from Scaled Composites, Armadillo from Armadillo Aerospace, and a demonstration vehicle by XCOR Aerospace.

ILS and BLS launch satellites to GEO from Cape Canaveral (CCAFS) in Florida. Sea Launch conducts GEO launches from a mobile ocean platform in the Eastern-central Pacific Ocean. Launches to NGSO can take place from CCAFS, Vandenberg Air Force Base (VAFB) in California, the Mid-Atlantic Regional Spaceport in Virginia, or Kodiak Launch Complex in Alaska (see figure “U.S. Launch Sites” above).

FAA/AST has issued four launch site operator licenses to state-run organizations to operate commercial launch sites, or spaceports. They are:

- Spaceport Florida at CCAFS, Florida (license held by Florida Space Authority);
- California Spaceport at VAFB, California (license held by Spaceport Systems International);

- Mid-Atlantic Regional Spaceport at Wallops Island, Virginia (license held by Virginia Commercial Space Flight Authority); and
- Kodiak Launch Complex on Kodiak Island, Alaska (license held by Alaska Aerospace Development Corporation), the first spaceport not located on a federal range.

Other states are actively seeking to develop additional spaceports, including New Mexico, Oklahoma, and Texas.

Several reusable suborbital vehicles are currently in development. The X Prize competition, modeled after the competitions in the early days of aviation for new aeronautical feats, plans to award a \$10 million prize for the first privately developed vehicle that carries a crew of three to an altitude of 100 kilometers (62 miles), and repeats the feat in less than 2 weeks. The competition has motivated more than 20 entrants to develop vehicles. The X Prize Foundation currently has funding to award a prize if a successful flight occurs by the end of 2004.

The Foundation is also in the process of selecting one of four sites to be a regular host of the X Prize

Cup, similar to an annual air show for the private space community. The four states being considered for the proposed annual event are California, Florida, Oklahoma and New Mexico.

REVIEW OF 2003

There were eight FAA-licensed launches in 2003, up from seven in 2002. ILS carried out four Atlas launches, all from Cape Canaveral. Sea Launch conducted three successful launches of GEO communications satellites from their Pacific Ocean platform, and Orbital Sciences Corporation conducted a successful launch of a remote sensing satellite from their Pegasus small vehicle.

Russian launch ranges deployed five vehicles for commercial missions. Europe's Arianespace conducted four commercial launch campaigns from Kourou in French Guiana, their lowest total since 1987. China did not launch any commercial payloads in 2003. Therefore, including the five launches from U.S. ranges and the three flights for Sea Launch, 17 orbital commercial launches were conducted during 2003. There were 64 total worldwide commercial, civil, and military launches, with commercial launches representing about 20 percent of total launches. For more details, see the Year In Review report available from the FAA/AST website at http://ast.faa.gov/rep_study/yir.htm.

COMMERCIAL SPACE TRANSPORTATION FORECASTS

In May 2003, the FAA and the Commercial Space Transportation Advisory Committee (COMSTAC) published their annual forecast for commercial

launch demand, the *2003 Commercial Space Transportation Forecasts*. This forecast combined the *COMSTAC 2003 Commercial Geostationary Launch Demand Model*, which covers satellites that operate in GEO, with the FAA's *2003 Commercial Space Transportation Projections for Non-Geosynchronous Orbits (NGSO)*. The forecast projected an average of nearly 24 commercial orbital launches worldwide annually through 2012.

The 2003-2012 forecasts project an annual average of:

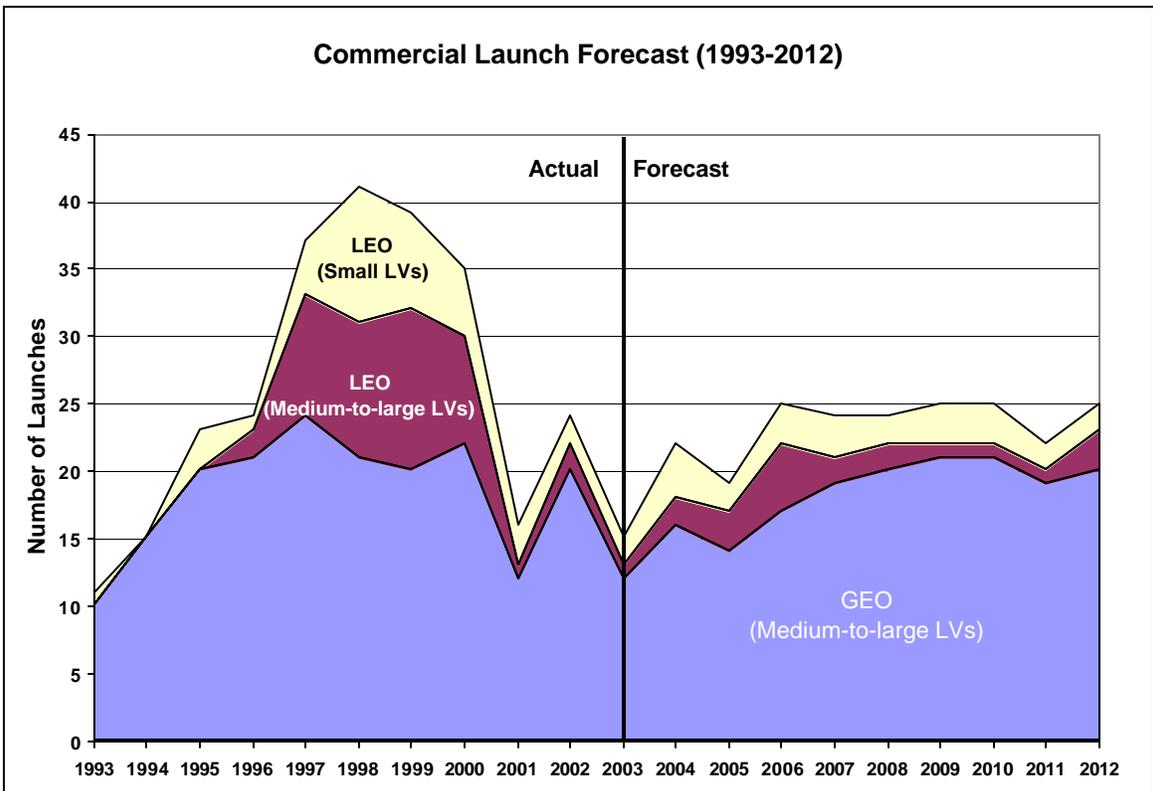
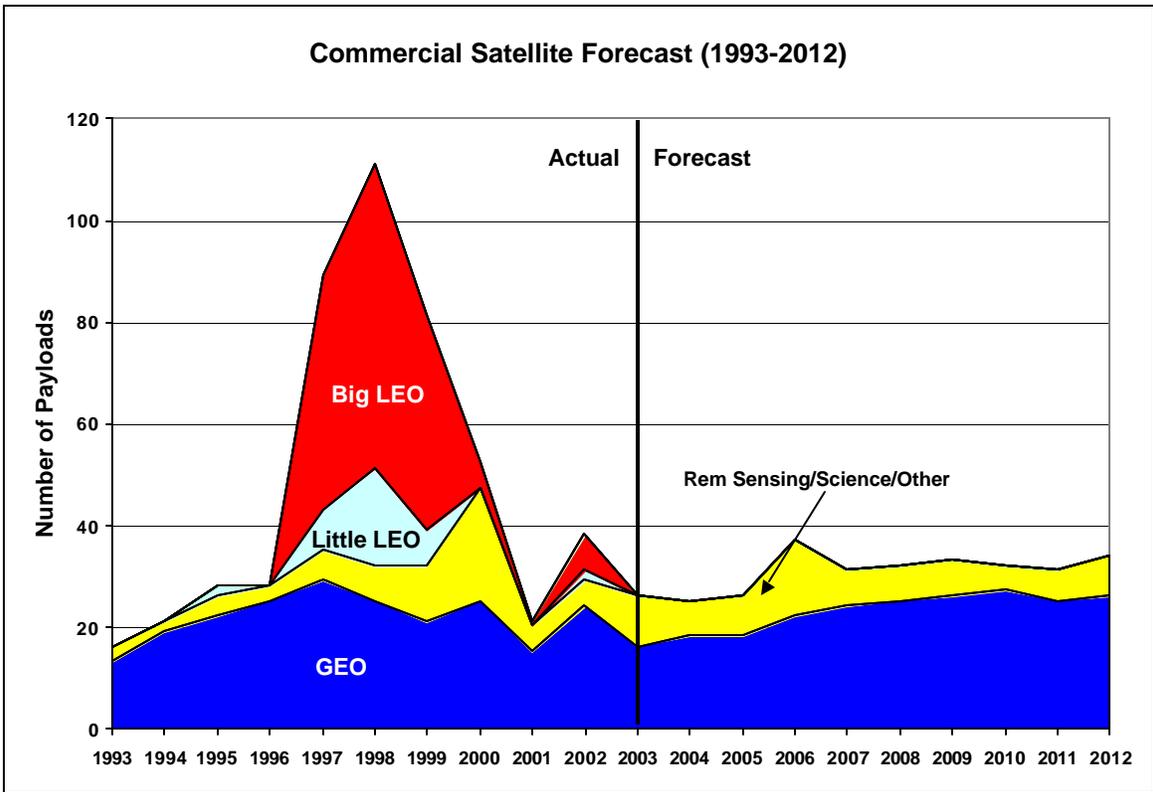
- 18.6 launches of medium-to-heavy vehicles to deploy GEO satellites;
- 2.2 launches of medium-to-heavy vehicles to NGSO; and
- 2.9 launches to NGSO by small vehicles.

These estimates account for multiple manifesting payloads, since commercial NGSO payloads could be launched in groups to reduce launch costs.

The forecast is based on industry inputs from across the satellite and launch service industry and represents the demand for launch services for actual or projected satellite programs in a given year. The forecast is not a prediction of what will actually be launched.

Several factors can affect the forecast, including satellite manufacturing delays, launch vehicle component problem launch failure investigations, or manifesting issues. Regulatory issues, such as satellite export compliance or FCC licensing, can come into play. Also, changes in the business environment can cause satellite companies to alter or cancel their development plans.

The complete forecast report is available at http://ast.faa.gov/rep_study/forecasts_and_reports.htm.



GENERAL TRENDS

The dominant feature of the commercial launch industry continues to be the launch of commercial satellites to GEO. There are also a small number of commercial launches to NGSO for remote sensing and international science payloads, but NGSO launches make up a considerably smaller portion of the market today than during the deployment phase of Iridium and Globalstar in the late 1990s. The NGSO telecommunications market has declined significantly, and the 2003 COMSTAC forecast projects the composition of NGSO payloads to be about 75 percent international science and research, and the remaining payloads for remote sensing. Only 4 of 17 commercial launches during 2003 contained NGSO payloads.

The commercial market generally has experienced a sharp decline in demand due to the global economic slowdown and business failures of first generation

mobile telecommunications companies. Launch activity is expected to grow only gradually over the next several years. U.S. commercial providers hope that new government markets open up for resupply of the International Space Station and possible future Moon missions.

The global marketplace continues to have a surplus in commercial launch capacity. The largest providers of commercial launch services in the United States, Europe, and Russia continue to operate fewer launches than in the recent past. New efforts to offer commercial services from Japan and Brazil have slowed because of vehicle failures and a generally crowded marketplace.

A revival of the suborbital market is expected soon, spurred by the emerging public space travel market and competition for X Prize. Developers inside and outside the United States hope to open space to ordinary passengers.